

**ELEVATOR APPARATUS
PANEL LINE FINDER AND
PANEL TRUNK FINDER
REQUIREMENTS AND ADJUSTING PROCEDURES**

1. GENERAL

1.01 This section covers panel line finder elevator apparatus and panel trunk finder elevator apparatus used with centralized "A" boards (13-type brushes; 3-, 8-, 10-, and 12-type brush rods; 4-type trip rods; 1-type trip magnets, 4-type bearings, and 1-type compensators).

1.02 This section is reissued to revise the requirement covering compensator tape protection and to revise the List of Tools and Materials. Detailed reasons for reissue will be found at the end of this section.

1.03 Reference shall be made to Section 020-010-711, covering general requirements and definitions, for additional information necessary for the proper application of the requirements listed herein.

Caution: Whenever adjustments are made on tripped multiple brushes, care shall be exercised to avoid crossing or grounding the brush spring on the terminal. If possible, set the brush on a spare or permanently made-busy terminal while adjustments are being made. Then recheck the adjustments on the reference terminal.

1.04 Operated Position of Trip Magnet: A trip magnet and its associated trip rod are said to be in the operated position when the non-freezing disc on the armature farther from the fulcrum is pressing against the associated pole piece.

1.05 Normal Position of Trip Magnet: A trip magnet armature and its associated trip rod are said to be in the normal position when the trip magnet armature is pressing against the backstop.

1.06 Trip Magnet Release: A trip magnet is said to *release* if, when the specified operate current is reduced to the specified release value, the armature returns to its normal position.

1.07 One drop of oil for the purpose of this section is the amount of oil released from a piece of 22-gauge bare, tinned copper wire after it has been dipped into oil to a depth of 1/2 inch and slowly removed.

1.08 Reference Terminal Alignment: A visual inspection shall be made before checking or readjusting any brush to insure that the reference sleeve terminal and the associated tip, ring, and hunt terminals of the same circuit group of terminals by which the brush is to be set are correctly aligned horizontally and vertically with respect to the other terminals in the bank.

1.09 Brushes equipped with flexible mounted tip and ring contact shoes are the same as the 13B brush except for the flexible shoe feature and except that the shoe contact material varies as follows.

BRUSH	SHOE CONTACT
D-156950	Silver Inlay
D-157333	Bronze
D-159839	Silver
13F	Silver

Except as covered herein, the requirements and adjusting procedures for 13-type brushes covered in the section apply to brushes equipped with flexibly mounted contact shoes.

1.10 Make-Busy Information

(a) **Except Trip Magnets and Trip Rods:**
Whenever it is found necessary to readjust a brush, brush rod, or compensator, make

the associated district selector or outgoing trunk circuit busy in the approved manner. To prevent the operation of the down drive armature, block the necessary relays or insulate the sequence switch springs.

(b) **Trip Magnets and Trip Rods:** Unless otherwise specified, whenever it is found necessary to readjust a trip magnet or trip rod, make busy all circuits which are associated with the trip rod. If it is necessary to operate the trip magnet electrically during periods of heavy load, remove the wire connected to the B terminal of the trip magnet (see Fig. 29) and establish a circuit from this terminal through the 35-type test set to ground as specified in the circuit requirements tables associated with the trip magnet under adjustment. During periods of light load, it may not be necessary to disconnect the wire from the magnet before operating the trip magnet electrically or to make busy the elevators which are associated with the trip magnet under test. In this case the test lead should be connected directly to the B terminal to operate the trip magnet electrically.

2. REQUIREMENTS

2.01 Lubrication

(a) **Rotating Levers and Trip Magnet Armature Extensions:** Fig. 1(A) — Before the installer starts the operation test, one coat of KS-8496 lubricating compound 3 shall be applied to the surfaces of the rotating levers and the trip magnet armature extensions where they come in contact with each other. Care shall be taken that none of the lubricant gets on adjacent apparatus or on the racks or the cork rolls of the drive.

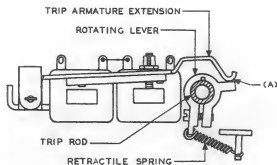


Fig. 1 - Trip Magnet and Associated Parts

(b) **Trip Rod Bearings:** Fig. 2(A) or 3(A) — Immediately before the installer starts the operation test, one drop of KS-16326 oil shall be applied to the trip rod bearings. Care shall be taken that the lubricant is applied to the bearing point only.

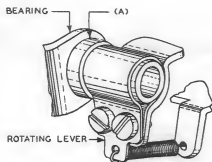


Fig. 2 - Later Style Rotating Lever

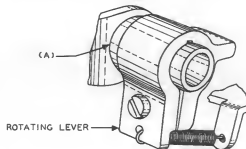


Fig. 3 - Earlier Style Rotating Lever

(c) **Recommended Lubrication Intervals:** After turnover, trip rod bearings which show signs of wear or bind and rotating levers and trip armature extensions which show signs of wear shall be lubricated at the discretion of the telephone company.

2.02 Compensator Tape Protection: Fig. 4(A)

— The compensator tape shall be greased with a thin coating of Veedol All Purpose grease at the discretion of the telephone company. Grease shall not be applied to the compensator bearings.

2.03 Compensator Bracket Location: Fig. 4(B)

and (C) — The bracket shall be clamped securely on the brush rod in such a way that the tape is not twisted and shall be so located that the further downward travel of the tape,

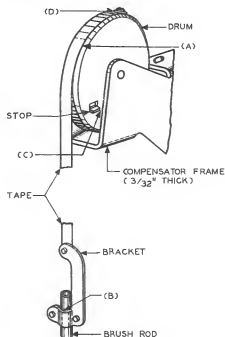


Fig. 4 - 1A Compensator

when the brush rod is in the normal (down) position, shall be

Test — Min 1/16 inch

Readjust — Min 1/8 inch

Gauge by eye.

The compensator frame is 3/32 inch thick.

2.04 Compensator Spring Tension: Fig. 4(D)

— When the compensator spring is extended to the position it will have when the brush rod is in the normal (down) position, it shall have, for a brush rod equipped with 15 brushes, a tension of

Min 300 grams

Max 400 grams

If the brush rod is only partially equipped with brushes, a reduction of 40 grams shall be made for each brush less than the full equipment of 15 brushes.

Use the 79B gauge.

To check this requirement, place the tip of the 79B gauge (see Fig. 5) against the screw holding the tape to the wheel. Push against this screw until the tension on the tape is removed

and the tape begins to buckle, and observe whether the required tension is registered. If there is insufficient room to permit the measurement of the tension in this manner, remove the steel band from the compensator bracket with the 3-inch C screwdriver and attach the 79B gauge to it at the eyelet by means of a piece of thin cord. Pull down on the gauge until the eyelet in the steel band is opposite the top screw hole in the brush rod clamp attached to the top of the brush rod, being sure to allow for the weight of the plunger. In this position the gauge should register a tension within the limits specified.

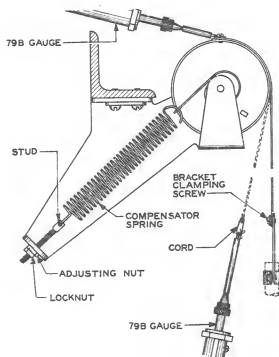


Fig. 5 - Method of Checking Compensator Spring Tension

2.05 Compensator Alignment: Fig. 4(A) —

The compensator shall be in alignment with the brush rod and the relation between the tape and the drum shall be such that

Test — The tape shall not overrun the edge of the drum more than 1/16 inch.

Readjust — The tape shall not overrun the edge of the drum.

Gauge by eye.

To check this requirement, sight along the tape with the rod in the normal (down) position. The tape should line up with the commutator in back of it. Run the brush rod up and down a few times and note the travel of the tape over the drum.

2.06 Rack Tongue Position: Fig. 6(A)

- (a) The rack tongue shall have sufficient tension to hold it against the rack coupling pin.

Gauge by feel.

- (b) With the weight of the brush rod assembly resting on the rack or rack bearing washer, the rack tongue shall not touch any of the four sides of the slot in the brush rod.

Gauge by eye.

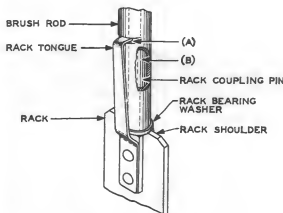


Fig. 6 - Brush Rod and Rack Parts

2.07 Rack Coupling Pin Engagement: Fig. 6(B)

The rack coupling pin shall be sufficiently free in the brush rod to allow the rod to rest on the rack bearing washer or the shoulder of the rack and to prevent any twisting motion of the rack within the limits permitted by requirement 2.06 being transmitted to the rod.

Gauge by eye.

To check this requirement, raise the brush rod away from the rack as far as permitted by the play of the rack tongue in its slot, and make sure that, when the brush rod is released, the brush rod drops back against the shoulder of

the rack or the rack bearing washer because of the weight of the brush rod. When checking for this requirement, make sure that no brush is tripped.

2.08 Freedom of Movement of Brush Rod: Fig. 7(A)

A brush rod shall be sufficiently free in its bearings to return to normal because of its own weight plus the weight of the rack when lowered slowly from any position except the brush restoring position with the clutch pawl free of the rack and with any brush tripped. On 300-point line finders, this requirement shall be met with the compensator attached.

Gauge by eye and feel.

To check this requirement, proceed as follows. With the brush rod normal, insert the KS-6320 orange stick in back of the left side of the clutch pawl and draw the pawl forward to free the rack. Turn the orange stick so the flat surface is next to the clutch frame and push the orange stick downward to wedge it in back of the clutch pawl as shown in Fig. 8. Raise the brush rod to its highest position, that is, with an upstop collar touching the underside of its associated bearing locating plate, and trip one brush. Exercise care when raising a brush rod which has a tendency to bind. Do not force the rod upward, but first check to see that the bind is not caused by a brush being tripped below its normal tripping position. Failure to observe this warning may result in either bending the trip finger out of alignment or damaging the rollers on the trip lever assembly. It may also result in injury to the brush rod. Place a finger under the frame of the lowest brush below the mounting screw in order to support the brush rod in its descent. Lower the brush rod slowly and evenly. See that the brush rod follows the movement of the finger without sticking or binding during its entire travel, that is, until the reset lever of a tripped brush touches the associated reset or bearing plate. It is not necessary that the tripped brush be reset by the combined weight of the rod and rack alone [see 2.25(b)].

2.09 Brush Rod Bearing Gap: Fig. 7(B)

The bearing halves of 4-type bearings shall be placed as closely together as possible without causing the brush rod to bind, and the

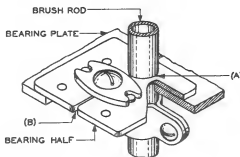


Fig. 7 - 4-Type Bearing

gap, if any, between the bearing halves at both front and rear of the bearing shall be

Max 0.005 inch

Gauge by eye.

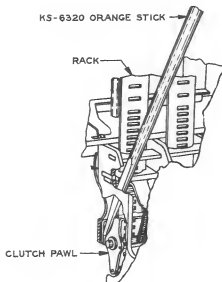


Fig. 8 - Method of Blocking Clutch Pawl

2.10 Armature Gap With Trip Magnet Normal: Fig. 9(A) — The gap between the nonfreezing disc and the pole piece farther from the fulcrum with the trip magnet in the normal position shall be

Test — Max 0.045 inch

Readjust — Max 0.040 inch

Use the 87A and 87B gauges.

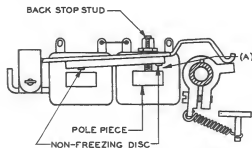


Fig. 9 - Trip Magnet Normal

2.11 Armature Gap With Trip Magnet Operated Manually: The gap between the nonfreezing disc and the pole piece nearer the fulcrum with the armature operated manually shall be

Min 0.003 inch

Max 0.012 inch

Use the 74D gauge.

To check this requirement, place the 0.012-inch blade of the 74D gauge between the armature nonfreezing disc nearer the fulcrum and the corresponding magnet core and press down the armature at a point directly over the gauge. Withdraw the gauge. The gauge should be felt to bind and the armature should snap into place as the gauge is withdrawn. Then operate the armature manually by grasping it immediately back of the armature backstop stud as shown in Fig. 10. Hold the armature in this position with the index finger and check that the 0.003-inch blade of the 74D gauge is free when placed between the nonfreezing disc and armature.

2.12 Clearance Between Trip Armature Extension and Hub of Rotating Lever: Fig. 11(A) — With the trip magnet operated electrically, the trip armature extension shall not touch the hub of the rotating lever.

Gauge by eye.

2.13 Engagement of Trip Armature Extension by Rotating Lever: Fig. 12(A) — With the parts in the position that they assume in normal operation, the sides of the trip armature extension shall not project beyond the sides of the rotating lever.

Gauge by eye.

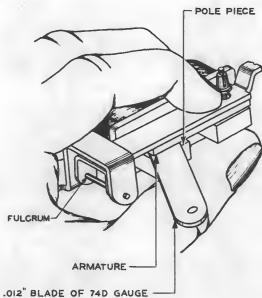


Fig. 10 - Method of Checking Minimum Armature Gap With Trip Magnet Operated Manually

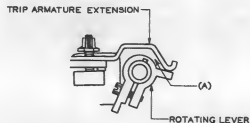


Fig. 11 - Clearance Between Trip Armature Extension and Hub of Rotating Lever

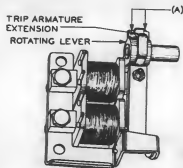


Fig. 12 - Engagement of Trip Armature Extension by Rotating Lever

2.14 Trip Rod Endplay: Fig. 13(A) — The trip rod shall have endplay, but the endplay shall not exceed 0.010 inch.

Gauge by eye.

2.15 Freedom of Movement of Trip Rod:

Fig. 13(B) — The trip rod shall be free in its bearings through its normal travel.

Gauge by feel.

To check this requirement, feel for play in an up and down and forward and backward direction at each bearing. Do not detach the retractile spring unless it is found impossible to detect the bind without so doing. If necessary, detach the retractile spring from the rotating lever with the P-long-nose pliers exercising great care not to distort the spring and check for bind as outlined above. Before hooking the retractile spring to the rotating lever, make sure that the other end of the spring passes through the hole in the retractile spring lug from the front. If the spring is not hooked to the retractile spring lug in this manner, remove the spring and hook it in the lug correctly. Then hook the spring to the rotating lever with the P-long-nose pliers and make sure that the end of the loop in the other end of the spring hooks over the outside edge of the retractile spring lug at either side, but not at the bottom (see Fig. 29).

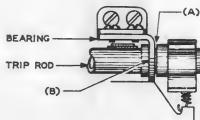


Fig. 13 - Trip Rod Bearing

2.16 Brush Stud Gap: Fig. 14(A)

(a) With the brush tripped and centered on the reference terminal of the bank, the stud gap shall be

Test — Min 0.005 inch

Readjust — Min 0.008 inch

To check this requirement, either use the 86 gauge or gauge by eye by pushing the

inner spring outward with the KS-6320 orange stick and note the amount of travel of the inner spring before the outer spring begins to move.

(b) The stud shall not touch the adjacent sleeve or hunt spring at any other terminal of the bank.

Gauge by eye.

(c) **Clearance Between Springs** (applies only to brushes equipped with flexibly mounted tip and ring contact shoes): With the brush in the normal (untripped) position, there shall be a clearance between the hunt or sleeve spring and the adjacent tip and ring springs of

Min 1/64 inch (the thickness of the brush spring)

Gauge by eye.

A slip of white paper inserted between the flexible shoe mountings and the brush frame will facilitate observing this spring clearance, particularly on the tip side of the brush.

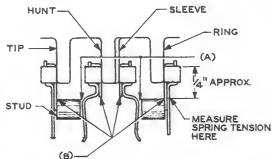


Fig. 14 – Brush Tripped on Reference Terminal

2.17 Clearance Between Brush Frame and Bank Terminals: Fig. 15(A) — With the rack index number 10 showing just above the clutch sighting plate and with the weight of the brush rod assembly resting on the clutch pawl, this clearance on the 0 banks shall be

Min 1/32 inch

On old-type 300-point frames which do not have bearing plates above the top bank, this clearance shall also be met at the top terminal of the top bank when the brush rod is raised so that the rack index number 19 shows just above the

clutch sighting plate and the weight of the brush rod assembly on the clutch pawl.

Gauge by eye.

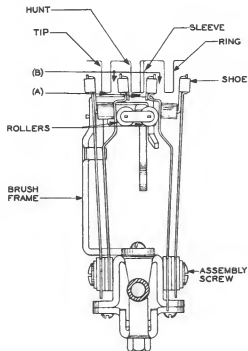


Fig. 15 – 13-Type Brush

2.18 Brush Intrusion: Fig. 16(A) — When the brush is tripped on any terminal in the bank, the contacting surfaces of the springs shall project in from the end of the terminal not less than half and not more than the full width of the shoe. This requirement may be checked at the top, bottom, and middle of the bank. It will be satisfactory if this requirement is slightly exceeded at the top or bottom of the bank in isolated cases, provided that these cases are not due to any general misalignment of the bank.

Gauge by eye.

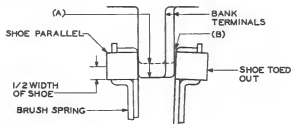


Fig. 16 – Brush Intrusion and Parallelism of Contacting Surface of Brush Springs

2.19 Horizontal Centering of Brushes:

Fig. 15(B) — With the rack index number 9 for the 20-line banks or the index number 20 for the 40-line banks showing just above the clutch sighting plate, with the weight of the brush rod assembly on the pawl, and with the brush in the reset position, the hunt and sleeve spring shoes shall not touch the tip and ring terminals.

Gauge by eye.

If one shoe touches its adjacent terminal, this requirement is met if the minimum clearance can be obtained in the following manner. Move the springs of the brush to the left or right until the back of the other shoe touches its adjacent terminal. Then release the pressure slowly, allow the brush to assume its normal position, and check for the clearance.

2.20 Tip and Ring Spring Clearance:

Fig. 17(A) — With the brush in its reset position, with the rack resting on the pawl for any position of the bank, and with the brush held so that the back of the hunt or sleeve spring farther from the tip or ring spring being tested is touching its adjacent tip or ring terminal, the clearance between either the tip or ring spring and its associated terminal shall be

Min 1/64 inch

Use the 89 gauge.

To check this requirement, raise the brush rod until the brush is in line with the reference terminal and check clearance. To insure a 1/64-inch clearance on any other terminal in the bank, make allowance for any lateral offset of the bank terminals.

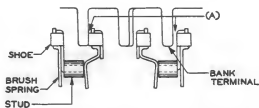


Fig. 17 — Tip and Ring Spring Clearance

2.21 Parallelism of Contacting Surface of Tip, Ring, Hunt, and Sleeve Brush Springs:

Fig. 16(B) — When the brush is contacting with the reference terminal, the deviation from parallel between the contacting surface of the tip, ring, hunt, or sleeve spring and the contacting surface of the terminal shall be as small as possible. In any case, when the brush intrusion equals the full width of the shoe, the shoe shall not toe out more than 0.005 inch [see Fig. 16(B)] and it shall not toe in. If the brush intrusion is less than the full width of the shoe, the amount that the spring and terminal may be out of parallel is proportional to the amount of brush intrusion, being 0.0025 inch when the brush intrusion equals one half the width of the shoe.

Gauge by eye.

To check this requirement, use the 510C test lamp as shown in Fig. 18.

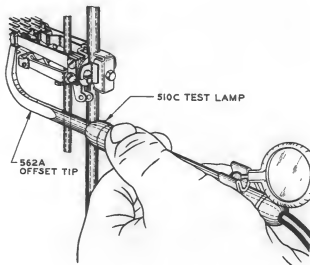


Fig. 18 — Method of Checking Parallelism

2.22 Brush Spring Tension: Fig. 14(B) — With the brush tripped and centered on the reference terminal of the bank, the tension of each spring shall be

- (a) For all springs except tip and ring springs of brushes equipped with rigidly mounted tip and ring contact shoes associated with banks treated with petrolatum compound and

for all springs of brushes equipped with flexibly mounted contact shoes

Test	— Min 25 grams
	— Max 50 grams
Readjust	— Min 30 grams
	— Max 45 grams

Use 68D gauge.

(b) For tip and ring springs only of brushes equipped with rigidly mounted contact shoes associated with bank treated with petrolatum compound

Test	— Min 40 grams
	— Max 65 grams
Readjust	— Min 45 grams
	— Max 60 grams

Use the 68D gauge.

(c) To check this requirement on brushes equipped with flexibly mounted tip and ring contact shoes, make the two adjacent circuits busy in order to avoid interference during the gauging operation when checking the tension of the tip and ring brush springs. Apply the tip of the 68D gauge at the crimp just back of the brush contact shoe as shown in Fig. 19. On all other brush springs, apply the 68D gauge at a point approximately 1/4 inch from the end of the spring.

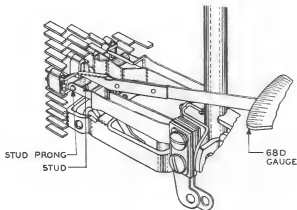


Fig. 19 — Method of Measuring Tension of Brush Springs

2.23 Hunt Spring Location: Fig. 20(A) — With the index number 9 for the 20-line banks or the index number 20 for the 40-line banks

showing just above the clutch sighting plate and with the weight of the brush rod assembly on the clutch pawl, the center of the hunt spring shall not be more than 0.010 inch above nor more than 0.010 inch below the center of the reference terminal.

Gauge by eye. (The bank terminals are 0.020 inch thick.)

Note: Where difficulty is experienced in checking this requirement due to lack of contrast between the fiber and the contacting surface of the brush shoe, proceed as covered in 3.006.

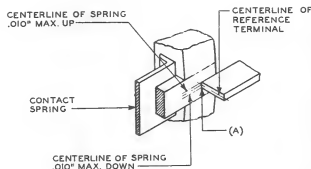


Fig. 20 — Hunt Spring

2.24 Tip, Ring, and Sleeve Spring Location: Fig. 21(A)

(a) **Test:** The upper edge of the contact portion of the spring shall not be below the upper edge of the terminal, and the lower edge of the contact portion of the spring shall not be above the lower edge of the terminal when the weight of the brush rod assembly is resting on the clutch pawl for any position on the bank.

Gauge by eye.

(b) **Readjust:** With the pawl engaging the notch in the rack corresponding to the reference terminal and with the weight of the brush rod resting on the clutch pawl, the upper edge of the contact portion of the brush spring shall be min 0.015 inch (3/4 thickness of terminal) above the top edge of the reference terminal, and the lower edge of the contact portion of the brush spring shall be

minimum 0.015 inch below the bottom edge of the reference terminal.

Gauge by eye.

Note: Where difficulty is experienced in checking this requirement due to lack of contrast between the fiber and the contacting surface of the brush shoe, proceed as covered in 3.006.

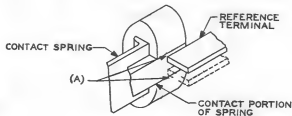


Fig. 21 - Tip, Ring, and Sleeve Spring Location

2.25 Downstop Collar Location: Fig. 22(A)

- (a) The downstop collar shall rest on the top clutch locating plate when the brush rod is in the normal or lowest position.

Gauge by eye.

- (b) When the brush rod is lowered under power, any tripped brush shall reset with a snap with a 0.010-inch gauge placed below the downstop collar.

Use the 74D gauge.

To check this requirement, proceed as follows. Raise the brush rod and trip the brush by hand. Place the 0.010-inch blade of the 74D gauge on the top clutch mounting plate in such a position that the clutch mounting ear will not interfere and so that the downstop

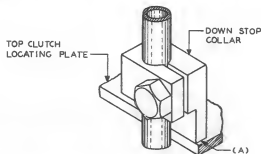


Fig. 22 - Downstop Collar

collar will come down on the gauge. Lower the brush rod under power and make sure that the brush resets with a snap before the brush rod comes to rest.

- 2.26 Clearance Between Trip Lever and Trip Rod:** Fig. 23(A) — With the brush rod in the normal or lowest position, this clearance shall be

Test — Min 0.005 inch

Readjust — Min 0.010 inch

Use the 139A gauge.

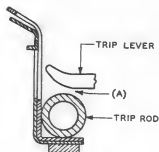


Fig. 23 - Clearance Between Trip Lever and Trip Rod

- 2.27 Clearance Between Trip Finger and End of Trip Lever:** Fig. 24(A) — With the trip rod operated and the brush rod in the normal or lowest position, the trip finger shall not touch the end of the trip lever.

Gauge by eye.

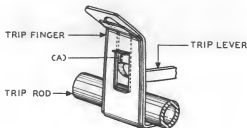


Fig. 24 - Clearance Between Trip Finger and Trip Lever

- 2.28 Clearance Between Brush Frame and Trip Rod Bearings:** Fig. 25(A) — With the brush rod in the normal or lowest position, the

brush frame shall not touch the trip rod bearing.

Gauge by eye.

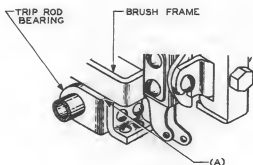


Fig. 25 - Clearance Between Brush Frame and Trip Rod Bearing

2.29 Clearance Between Upstop Collar and Bottom of Bearing Plate: Fig. 26(A)

(a) With the index number 20 for the 20-line bank or the index number 41 for the 40-line bank showing just above the clutch sighting plate and with the weight of the brush rod assembly on the pawl, this clearance shall be

Min 0.080 inch

Max 0.110 inch

Use the 83B and 84B gauges.

(b) With the brush rod raised to the upper limit of its travel so that one upstop collar touches the bottom of the bearing plate, the clearance, if any, between the other upstop collar and the bottom of its bearing plate shall be

Max 0.005 inch

Gauge by eye.

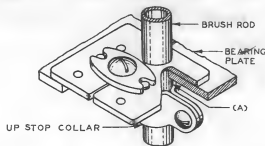


Fig. 26 - Upstop Collar and Bearing Plate

2.30 Clearance Between Trip Lever and Sides of Slots in Trip Finger: Fig. 27(A) —

With the endplay of the trip rod taken up to the left or right, the trip lever shall not touch the sides of the slots in the trip finger.

Gauge by eye.

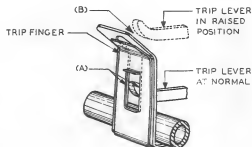


Fig. 27 - Clearance Between Trip Lever and Sides of Slots in Trip Finger

2.31 Clearance Between Trip Lever and Trip Finger: Fig. 28(A) —

With the trip rod in the normal position and the brush rod raised, this clearance shall be

Min 0.005 inch

Gauge by eye.

To check this requirement, proceed as follows. Grasp the brush rod as far as convenient from the brush being checked to reduce the possibility of pressure against the brush rod affecting the position of the trip lever when the brush rod is raised. Then raise the brush rod and check the clearance as the trip lever passes the trip finger.

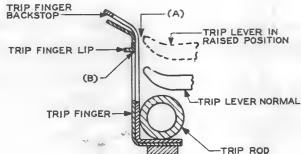


Fig. 28 - Clearance Between Trip Lever and Trip Finger

2.32 Location of Trip Finger Backstop With Respect to Trip Lever: Fig. 27(B) —

With the trip magnet operated and with the brush reset, the top edge of the slot in the trip finger backstop shall not touch the end of the trip lever as the trip lever passes the trip finger backstop.

Gauge by eye.

2.33 Pressure of Trip Fingers Against Their Backstops: Fig. 28(B) — This shall be

Test	— Min 20 grams
	— Max 70 grams
Readjust	— Min 30 grams
	— Max 60 grams

Use the 79C gauge.

To check this requirement, pull the trip fingers away from their backstops by placing the tip of the 79C gram gauge behind the trip finger at the point where lip is bent back and read the gauge at the instant the trip finger leaves the backstop.

2.34 Retractable Spring Tension: Fig. 29(A) —

The tension of the rotating lever retractile spring shall be sufficient to restore the trip rod to its normal position and press the trip magnet armature against its backstop.

Gauge by eye and feel.

Note: In checking for tension, make sure that the open end of the retractile spring loop rests against the outside edge of the retractile spring lug at either side but not at the bottom.

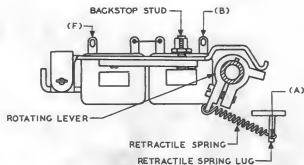


Fig. 29 — Retractable Spring Tension

2.35 Trip Magnet Operate and Release

- (a) The trip magnet shall operate and release on the following current values.

Test	— Operate, 0.160 amp
	— Release, 0.035 amp
Readjust	— Operate, 0.150 amp
	— Release, 0.040 amp

- (b) When two trip magnets are wired in parallel, they shall operate and release on twice the values specified above.

- (c) When four trip magnets are wired in parallel, they shall operate and release on four times the values specified above.

- (d) The trip magnet shall operate on the specified current at the rate of approximately two times a second.

- (e) With the trip magnet fully operated, there shall be

Min 0.003 inch

further travel of the trip rod without bind.

Gauge by eye and by feel.

2.36 Brush Tripping Test: Fig. 30(A) — The brushes shall trip when the trip magnet is energized with a

Test	— 0.010-inch
Readjust	— 0.012-inch

gauge placed between the pole piece and the nonfreezing disc on the armature farther from the fulcrum and the brush rod is raised by means of the clutch-up drive.

Use the 102A gauge.

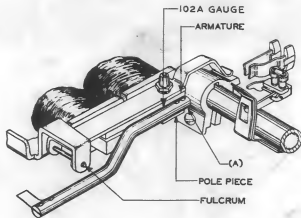


Fig. 30 — Brush-Tripping Test

2.37 Smooth Brush Travel: With the brush tripped and as the selector travels up and down in normal operation, each brush shall meet the following conditions.

- (a) It shall run smoothly over the bank terminals without chattering.
 - (b) It shall not snag against the bank terminals.
 - (c) It shall not ride off the bank terminals.
- Gauge by eye.

To check this requirement, proceed as follows. Trip the brush and run it to its topmost position under power. Watch the brush reset lever to detect whether it jiggles or vibrates. If so, lower the brush. Block the clutch pawl with the KS-6320 orange stick as covered in 2.08. Retrip the brush and run it up and down slowly by hand and note if any of the spring contacts catch slightly on the terminals at any part of the bank. A heavy tension on the clutch pawl spring will sometimes cause the zero brush reset lever to vibrate. Eliminate this by holding the down-drive armature operated enough to remove the pawl while the rod is being driven up.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, Materials, and Test Apparatus

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
48	Combination 7/32- and 1/4-Inch Hex. Double-End Socket Wrench and Screwdriver
206	30-Degree Offset Screwdriver
207	90-Degree Offset Screwdriver
245	3/8- and 7/16-Inch Hex. Open Double-End Flat Wrench
246	1/2-Inch Hex. Open Single-End Flat Wrench
310B (2 reqd)	9/32-Inch Hex. Open Double-End Offset Wrench
325B	Adjuster
330B (2 reqd)	Adjuster

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
331	Spring Adjuster
344	Offset Screwdriver
376A	Dental Mirror
R-2830 or 380A	Spring Adjuster
382A	Trip Rod Holder
417A	1/4- and 3/8-Inch Hex. Open Double-End Flat Wrench
489A	Stud Adjusting Pliers
510C	Test Lamp [must be equipped with 562A tool (offset tip) and W2BL (48V) cord]
555A	3/16-Inch Hex. Single-End Socket Wrench
583A	Spring Adjuster
KS-2630	5/16-Inch Hex. Offset Socket Wrench
KS-2631	4-Inch Screwdriver
KS-2632	Reading Glass
KS-6015	Duckbill Pliers
KS-6320	Orange Stick
KS-6367	7/16- and 5/8-Inch Hex. Open Double-End Flat Wrench
KS-14164	Brush
—	P-Long-Nose Pliers
—	3-Inch C Screwdriver (or the re-placed 3-inch cabinet screwdriver)
—	4-Inch E Screwdriver (or the re-placed 4-inch regular screwdriver)
—	5-Inch E Screwdriver (or the re-placed 5-inch regular screwdriver)
GAUGES	
68D	70-0-70 Gram Gauge
74D	Thickness Gauge Nest
79B	0-1000 Gram Push-Pull Tension Gauge
79C	0-200 Gram Push-Pull Tension Gauge

SECTION 026-125-703

CODE OR SPEC NO.	DESCRIPTION
GAUGES	
83B	0.080- and 0.100-Inch Double-End Thickness Gauge
84B	0.110- and 0.120-Inch Double-End Thickness Gauge
86	0.005- and 0.008-Inch Double-End Offset Thickness Gauge
87A	0.022- and 0.040-Inch Double-End Thickness Gauge
87B	0.030- and 0.045-Inch Double-End Thickness Gauge
89	1/16- and 1/64-Inch Round Thickness Gauge
102A	0.010- and 0.012-Inch Double-End Thickness Gauge
139A	Thickness Gauge Nest

MATERIALS	
KS-2423	Cloth
KS-7860	Petroleum Spirits
KS-8496	Lubricating Compound 3
KS-14666	Cloth
KS-14694	Scouring Pad
-KS-16326	Oil (or the replaced KS-2245 oil)
—	Cord
—	Veedol All Purpose Grease (or the replaced Veedol medium cup grease)
—	Piece of 22-Gauge Bare, Tinned Copper Wire
—	Dixon G712 Graphite Lubricating Stick (The Joseph Dixon Crucible Co, Jersey City, N. J.)

TEST APPARATUS	
—	35-Type Test Set

3.002 Use of Reading Glass and Dental Mirror: The KS-2632 reading glass and the 376A dental mirror may be used in connection with the visual inspections specified in Part 2 and the corresponding adjusting procedures.

3.003 Shifting Brushes Horizontally: Exercise care when shifting a brush horizontally to avoid moving the brush up or down since this may destroy other adjustments. To shift a brush horizontally, loosen the brush clamping bracket screw with the 555A wrench, taking care not to loosen the screw more than necessary. Rotate the brush slightly with respect to the brush rod so that requirements 2.16, 2.17, 2.19 through 2.22, and 2.30 are met. Securely tighten the brush clamping bracket screw.

3.004 Shifting Brushes Up or Down: To shift brush up or down, loosen the brush clamping bracket screw slightly with the 555A wrench. With the wrench on the screw, tap the shank of the wrench up or down as required. Do not tap the frame of the brush in making this adjustment since this may mar the finish or distort some part of the brush assembly. Since the horizontal setting of the brush may be disturbed in shifting the brush up or down, check the requirements listed in 3.003 and in addition check requirements 2.23 through 2.28 and 2.31. Securely tighten the brush clamping bracket screw.

3.005 Before making any of the readjustments covered in this section pertaining to trip rods or trip magnets, make a check to determine that the trip magnets are mounted firmly on the frame. Tighten the mounting screws by means of the 344 offset screwdriver and the 417A wrench.

3.006 To clean brush shoes, proceed as follows. Where a brush appears dirty, clean the brush and guide comb as covered in Section 069-605-801. Where a brush is equipped with silver tip and ring contacts which have acquired a dark sulphide film, clean them as follows. From a KS-14694 scouring pad, cut a strip across the pile, 1/2 inch wide by 2 inches long. Fold the pad over the end of a KS-6320 orange stick with the pile side out and secure the pad to the orange stick by means of a rubber band. Saturate the pad with KS-7860 petroleum spirits. With the brush in the normal (down) position, abrade the contacting portion of the brush shoe with a few strokes of the pad.

3.01 Lubrication (Req't 2.01)

(1) **Trip Rod Bearings:** Raise the brush rod adjacent to the bearing so that the brush will not interfere with the process of lu-

bricating the bearing. Apply one drop of KS-16326 oil by means of a piece of 22-gauge, bare, tinned copper wire to the oil hole in the trip rod bearing, making sure that it is applied to this point only. Work the lubricant in by moving the trip rod sideways and up and down in its bearings.

Rotating Levers and Trip Magnet Armature Extension

(2) To lubricate the rotating levers and trip magnet armature extensions which are associated with trip magnets mounted at the extreme right side of the frame, it is necessary first to make the end selector busy and to raise it approximately halfway up the bank. Dip the KS-14164 brush into the KS-8496 lubricating compound 3 and insert the brush between the two selectors at the end of the frame. With the index finger of the right hand, hold up the trip magnet armature and draw down the rotating lever with the middle finger as shown in Fig. 31 so as to allow room for the brush to reach the surface of the rotating lever which rubs against the trip magnet armature extension. Then release the ro-

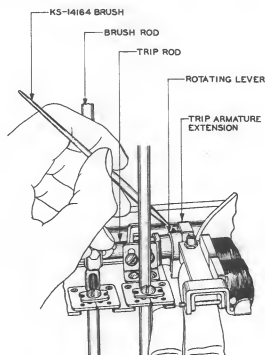


Fig. 31 - Method of Lubricating Rotating Lever and Trip Armature Extension at Right of Frame

tating lever and slowly withdraw the brush. This will squeeze the lubricant from the brush onto the two surfaces to be lubricated. Take care that the lubricant does not get on adjacent apparatus or on the racks or cork rolls of the drive.

(3) To lubricate the rotating levers and trip magnet armature extensions associated with the trip magnets mounted on the extreme left side of the frame, insert the brush from the left, in back of the front upright frame angle. Hold the trip magnet armature and drawn down the rotating lever, insert the brush between the rotating lever and the trip armature extension as shown in Fig. 32, release the rotating lever, and apply the lubricant as covered in (2).

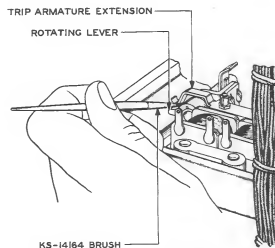


Fig. 32 - Method of Lubricating Rotating Lever and Trip Armature Extension at Left of Frame

(4) After applying the lubricant, it is advisable, if service conditions permit, to keep the rotating lever from rubbing on the trip armature extension for 15 minutes to permit the solvent in the lubricant to evaporate.

3.02 Compensator Tape Protection (Reqt 2.02)

(1) Before lubricating the compensator tapes, clean the surfaces of the tape and drum by wiping them with a piece of KS-14666 cloth. Then lubricate the tapes by wiping the surfaces with a clean piece of KS-14666 cloth

- saturated with Veedol All Purpose grease. Take care not to apply too much lubricant. Just enough lubricant to cover the surfaces with a thin film is sufficient.

3.03 *Compensator Bracket Location* (Reqt 2.03)

(1) If the bracket is not properly located, loosen the bracket clamping screws with a 3-inch C screwdriver and, with the brush rod in the normal (down) position, pull down the tape until the stop on the drum strikes the frame of the compensator. Then clamp the bracket loosely to the brush rod so that all the slack is removed from the tape. Note the position on the rod now occupied by the bracket. With the blade of the screwdriver, tap the bracket until it occupies a position approximately 1/8 inch higher than that previously noted. Turn the bracket until all twist is removed from the tape and securely fasten the bracket to the rod.

3.04 *Compensator Spring Tension* (Reqt 2.04)

(1) To adjust the compensator spring tension, hold the compensator spring stud adjusting nut with one 310B wrench and loosen the locknut with another 310B wrench. Adjust the spring tension as required by turning the adjusting nut. When the desired tension is obtained, securely tighten the locknut.

3.05 *Compensator Alignment* (Reqt 2.05)

(1) To correct for any misalignment, first check several compensators for alignment to determine whether there is a general condition of misalignment on that side of the frame. If such is the case, loosen the bolts by which the compensator mounting angle iron is fastened to the frame with the KS-6367 wrench, using the 246 wrench or the 5-inch E screwdriver to hold the bolt. Then shift the angle iron to the right or left as required.

(2) If it is found that the individual compensator is out of alignment, correct by loosening the compensator mounting screws with the 4-inch E screwdriver and shifting the compensator to the desired position.

3.06 *Rack Tongue Position* (Reqt 2.06)

(1) If the rack tongue does not assume its correct position in the brush rod, it is either distorted or the brush rod is twisted. If

the rack tongue is distorted, straighten it with a pair of P-long-nose pliers. If the brush rod is twisted, loosen the brushes and the commutator brush with the 555A wrench and turn the rod to its correct position; then relocate all the brushes in accordance with the requirements for this apparatus specified herein or in Section 026-120-701.

3.07 *Rack Coupling Pin Engagement* (Reqt 2.07)

(1) If the rod appears to bind on the rack coupling pin, that is, if the rod does not return to the shoulder of the rack or the rack bearing washer when raised and released as specified, first make certain that this is not caused by a binding or bowed brush rod (see 3.08 and 3.09). If the brush rod is not binding or bowed, uncouple the rack and examine the coupling pin to see that it is not bent; also, see that there are no short bends in the lower end of the brush rod. Check to see that there are no burrs or dirt in the hole in the brush rod and that the hole is large enough to permit the rack coupling pin to enter freely.

(2) If the brush rod is worn at the bottom so that it does not twist freely on the rack shoulder, it may be necessary to recondition the bottom of the brush rod as covered in Section 026-125-803.

3.08 *Freedom of Movement of Brush Rod* (Reqt 2.08)

3.09 *Brush Rod Bearing Gap* (Reqt 2.09)

(1) Check to see that there is no interference caused by the commutator brush local cable form coming in contact with a commutator or the form snagging on an adjacent brush frame. Also, make sure that when the brush rod is lowered to the normal position, the top of the rack is above the underside of the rack guide so as to avoid the possibility of the rack snagging on the rack guide. If the latter condition exists, lower the brush rod downstop collar slightly as covered in 3.25, making sure that requirement 2.25 is met.

(2) Binding of the brush rod may be caused by dirt accumulations on the rod or by improper mechanical adjustment. If the bind is due to dirt accumulations, treat the surfaces of the rod with Dixon G712 graphite

lubricating stick as follows. Where graphite has not previously been used, clean all accessible portions of the rod above the brushes with a KS-2423 cloth moistened with KS-7860 petroleum spirits, taking care to keep on those portions of the rod at least 1 inch from the brushes. Raise the brush rod and similarly clean the portions of the rod below the brushes which engage the bearings when the rod is normal. Then apply graphite to the rod as covered in (3). Where graphite has previously been used, subsequent cleaning of the brush rod with the cloth and petroleum spirits will ordinarily not be necessary.

(3) With the brush rod in the normal position, apply Dixon G712 graphite lubricating stick over the front and side surfaces of the rod with a downward motion and moderate pressure. Three such strokes will usually be sufficient. Take care to keep on that portion of the rod at least 1 inch from the brushes and bearings. Repeat this operation for each section of the rod. Then rub the rod lightly with a dry KS-2423 cloth so as to distribute the graphite over all accessible portions of the rod.

(4) When the cloths become dirty, discard them in a suitable container.

(5) If the brush rod still does not move freely, proceed as follows.

(6) If a bind sufficient to prevent the brush rod from meeting this requirement occurs at or near the top of the brush rod travel, the cause may be a misaligned clutch. To determine the cause, uncouple the rack and raise the brush rod as high as it will go. If the bind has been removed, it may have been caused by a misaligned clutch.

(7) If the clutch appears to be out of alignment, refer to the section covering the particular type of clutch involved. If necessary, re-align the clutch and then recheck the commutator brush for height. Also, check requirements 2.23 through 2.29 and recheck the brushes on the 0 and 1 banks for requirement 2.19, since the adjustment for alignment will have changed the position of the clutch.

(8) If the brush rod binds only in spots throughout its travel, the binding may be caused by interference between the bearings and by bumps or spots of paint or shellac on

the brush rod. Stop the rod on one of the binding spots and check each bearing, in turn, for play in a straight front-to-rear direction by grasping the rod in the fingers directly below the bearing and moving it backwards and forwards and then from side to side. If the bearing does not show a perceptible play, examine the rod carefully to determine the cause of the bind. Remove spots of paint or shellac by scraping the rod with the side of a screwdriver blade taking care not to nick the rod.

(9) Before separating the halves of a bearing, make sure that the bind is not caused by misalignment of the bearing halves. To check for this condition, move the rod first from side to side and then from front to rear. Such misalignment is generally due to the front and rear displacement of one half of the bearing with respect to the other half. Correct by lightly tapping the bearing halves with the screwdriver handle.

(10) Close bearings that are open more than the permissible amount by tapping the bearing half into the correct position with the 3-inch C screwdriver. Always dress the bearing halves to the left and to the rear. Do not pry against the adjacent bearing. A lamp held just below the bearing locating plate will be found to be of considerable help in checking for open bearings.

(11) What may seem to be a uniform bind throughout the travel of the brush rod is probably caused by excessive brush spring tension. Check the tensions of all the brush springs and, where they are found to be excessive or close to the maximum requirements, reduce them slightly. Try to apportion the adjustment so as to set each spring approximately at its mean requirements rather than to reduce any one spring to its minimum requirements. Refer to 3.22 and to Section 026-120-701 when it is necessary to make this check or adjustment.

(12) Such binds as are caused by kinks and bends in the brush rod will also be noticed as occurring only in certain spots during the travel of the rod. If there is front-to-rear play in every bearing and if there is no bind due to heavy brush tension or interference with a misaligned clutch, examine the

rod carefully to ascertain whether it is straight throughout its entire length. If kinks or bends are located, straighten the rod by grasping it in the fingers above and below the bent portion and bowing the rod in a direction to correct the bend. After straightening the rod, check requirements 2.17 through 2.20, 2.23, and 2.24. If the fault cannot be discovered in any other way, remove one pair of bearings at a time. With a bearing removed in this manner, that part of the rod that is bowed will be plainly shown by its position with respect to the bearing supporting plate. Reassemble the bearing.

3.10 *Armature Gap With Trip Magnet Normal* (Req't 2.10)

(1) To readjust the gap between the non-freezing disc and the pole piece farther from the fulcrum, place the 0.040-inch step of the 87A gauge between the nonfreezing disc on the armature farther from the fulcrum and the magnet core. Turn down the armature backstop with the 48 wrench until the non-freezing disc on the armature touches the gauge. In making this adjustment, take care to keep this gap close to the maximum limit since decreasing this gap decreases the amount of movement in the trip rod.

3.11 *Armature Gap With Trip Magnet Operated Manually* (Req't 2.11)

(1) To readjust the armature gap, attach the 325B adjuster to the trip magnet armature as near as possible to the fulcrum. Press down on the end of the adjuster to increase the gap and press up to decrease the gap.

3.12 *Clearance Between Trip Armature Extension and Hub of Rotating Lever* (Req't 2.12)

3.13 *Engagement of Trip Armature Extension by Rotating Lever* (Req't 2.13)

(1) To readjust for these requirements, loosen the trip magnet mounting screws with the 344 offset screwdriver and the 417A wrench and shift the trip magnet. Securely retighten the mounting screws. The clearance between the trip armature extension and hub of the rotating lever may also be adjusted by means of the 325B adjuster.

3.14 *Trip Rod Endplay* (Req't 2.14)

(1) When the endplay is controlled by the rotating lever, increase or decrease the play by loosening the rotating lever screw or screws with the 3-inch C screwdriver and moving the rotating lever to the right or left as required. After moving the rotating lever, check to see that requirement 2.13 can be met.

(2) When the endplay is controlled by the bearing, increase or decrease the play by loosening the screws holding the bearing mounting plate to the frame cross member with the 3-inch C screwdriver and moving the bearing assembly to the right or left as required.

3.15 *Freedom of Movement of Trip Rod* (Req't 2.15)

(1) If the bearing causing the bind cannot be discovered as outlined in the requirement, loosen one of the screws holding the bearing mounting plate to the mounting bracket on the bearing assembly farther from the rotating lever with the KS-2631 screwdriver. Operate the trip rod by hand and move the free end of the bearing plate up and down until the spot at which it has least friction is found. Tighten the mounting screws. Also, determine whether the bind is caused by the trip finger rubbing against the mounting plate and, if so, adjust the trip finger backstop as outlined in 3.32.

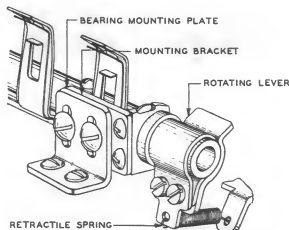


Fig. 33 - Bearing Mounting Parts

(2) If this does not remove the bind, loosen the screws holding the bearing mounting bracket to the frame cross member with the 3-inch C screwdriver and shift the bracket backward and forward until the point or position of least friction is found. Be sure to tighten the screws on the bracket and bearing. If possible, do not loosen more than one screw on each bearing or bracket, or the vertical or horizontal adjustment of the trip rod will be lost. If the readjustment of this bearing does not remove the bind, perform the foregoing operations on the other bearings. After shifting the bearings, recheck requirements 2.12, 2.13, 2.14, 2.26, 2.27, 2.28, 2.30, and 2.31.

(3) Make sure that the armature clears the backstop stud on all sides. Failure to do this is usually due to a misplaced magnet core which may be corrected by loosening the magnet coil mounting screw with the 245 wrench and adjusting as required. It may be necessary to loosen the trip magnet mounting screws as outlined in 3.12 and 3.13.

3.16 Brush Stud Gap (Req't 2.16)

(1) Unless the sleeve or hunt springs are distorted, adjust the stud gap by adjusting the outside springs as shown in Fig. 34 using the 331 spring adjuster. Use extreme care in making the necessary corrections to restore the spring to its correct condition.

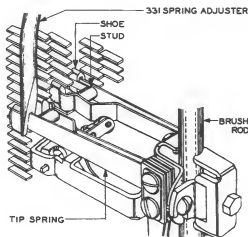


Fig. 34 - Method of Adjusting for Brush Stud Gap

(2) **Brushes Equipped With Flexibly Mounted Tip and Ring Contact Shoes:** Adjust the stud gap with the 583A spring adjuster. Apply the adjuster near the base of the stud prong, taking care not to apply pressure against the stud in a direction which would tend to force the stud off the prong. Then reset the brush and check to see that (c) of the requirement is met.

3.17 Clearance Between Brush Frame and Bank Terminals (Req't 2.17)

(1) Determine if the condition is caused by a bowed rack and, if so, straighten it by following the procedures outlined in the section covering the particular type of clutch involved.

(2) If the necessary clearance is not now visible, inspect the brush rod for kinks, bows, or a bent condition at the rack tongue slot. Remove any bowing or kinking of the rod as covered in 3.08 and 3.09. If the required clearance is still unobtainable, move the bearing closest to the faulty part of the rod so as to obtain the required clearance. Take care, however, not to move the bearing enough to prevent the brush from meeting requirements 2.08 and 2.18.

(3) If the required clearance cannot be met on the top banks on 300-point frames which are not equipped with a bearing plate between the top bank and the commutators, the trouble may be due to a bent or bowed brush rod. Correct this condition as outlined in 3.08 and 3.09.

3.18 Brush Intrusion (Req't 2.18)

(1) If failure to meet the brush intrusion requirement is common to several adjacent brushes on one bank, it is an indication that the bank is out of alignment. Where the cases of failure are isolated, make a check to see whether or not the brush rod is bent in or out and, if so, straighten the brush rod as covered in 3.08 and 3.09. If, however, the brush rod is straight and this condition exists, do not bend the brush rod to correct it. It is sometimes possible to correct the above conditions by moving the brush rod bearings. Since the brush itself is not involved in this adjustment, do not readjust it to meet this requirement. If, however, any of the adjustments covered

above are made, check requirements 2.17, 2.19, 2.20, 2.22, 2.23, and 2.24. It is satisfactory if, in isolated cases, a brush only approximately meets the requirement at the top or bottom of the bank, provided it meets it at the reference terminal and provided a check is made with other brushes to insure that the failure to meet the requirement is not due to misalignment of the bank.

3.19 Horizontal Centering of Brushes (Reqt 2.19)

(1) If there is no clearance between the back of one sleeve or hunt shoe and a tip or ring terminal and there is a large clearance between the back of the other sleeve shoe and its associated tip or ring terminal, this condition will usually be caused by the whole brush assembly being shifted sideways. To correct this, shift the brush horizontally slightly as covered in 3.003, so that both sleeve springs will be approximately equidistant from the adjacent sleeve terminal.

(2) If it is found impossible to obtain the desired clearance by following (1) and either or both of the sleeve or hunt spring shoes still make contact with the tip or ring terminals, it will generally be found that the gap between the sleeve or hunt spring at fault and the adjacent tip or ring spring at the first bend of the sleeve or hunt spring will be much greater than normal. To correct this condition, apply the 380A or R-2830 adjuster close to the base of the faulty spring and push it toward the contact end of the spring while exerting a slight twisting pressure that will bow the spring outward. It may be necessary to repeat this operation to obtain a clearance. Recheck requirement 2.16.

3.20 Tip and Ring Spring Clearance (Reqt 2.20)

(1) Examine the brush to see if it is in accordance with Fig. 35 to determine what corrective measures are necessary to meet the requirement.

(2) If the brush springs are not distorted but the stud gap is larger than required, reduce the stud gap as covered in 3.16. Check requirements 2.19, 2.21, and 2.22.

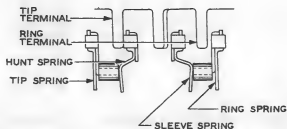


Fig. 35 - Tip and Ring Spring Clearance When Brush Springs Are Pressed to Left Until Back of Hunt Spring Makes Contact With Tip Terminal

3.21 Parallelism of Contacting Surface of Tip, Ring, Hunt, and Sleeve Brush Springs (Reqt 2.21)

(1) Adjust the brush springs at a point in front of the studs with the 331 adjuster so that the contacting surfaces of the shoes are parallel to the terminals or toe out slightly but do not toe in (see Fig. 36). Recheck requirements 2.16, 2.23, and 2.24. In some cases, because of the changed shape of the springs, it may be necessary to decrease the effective length of the stud slightly by pressing it onto the stud mounting pin with the 489A stud adjusting pliers. In using these pliers, engage the stud with the tip of the pliers and press the stud onto the stud mounting pin as far as permitted by the stop between the jaws of the pliers as shown in Fig. 37. Make sure that the stud mounting pin does not protrude beyond the stud and short-circuit the springs.

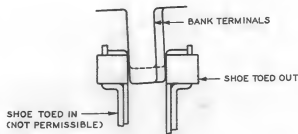


Fig. 36 - Toe-In and Toe-Out Condition of Brush Shoes

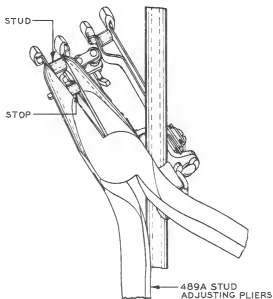


Fig. 37 - Method of Decreasing Effective Length of Stud

(2) **Brushes Equipped With Flexibly Mounted Tip and Ring Contact Shoes:** With the brush in the "reset" position, the tip and ring shoes may toe in. No attention need be paid to this condition if the brush meets its requirements. Adjust the parallelism of the tip and ring brush shoes with the 583A spring adjuster applied as shown in Fig. 38. Take care to engage both members of the flexible shoe mounting so that they will be adjusted equally and thereby avoid tilting the shoe. After this adjustment has been made, recheck 2.16(c). Adjust for parallelism on the sleeve and hunt brush shoes in the same manner as on brushes equipped with rigidly mounted contact shoes.

3.22 Brush Spring Tension (Req't 2.22)

- (1) Readjust the spring tension with the 380A or R-2830 spring adjuster close to the point where the spring leaves the assembly clamping plates and insulators.

3.23 Hunt Spring Location (Req't 2.23)

3.24 Tip, Ring, and Sleeve Spring Location (Req't 2.24)

- (1) If these requirements are not met and the brush rod is coupled to a 3A or 4A rack, first ascertain that the brush rod is not worn

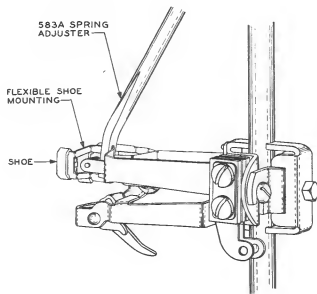


Fig. 38 - Method of Adjusting for Parallelism of Tip and Ring Brush Shoes

excessively at the bottom where it rests on the shoulder of the rack. If necessary, recondition the lower end of the brush rod as covered in Section 026-125-803.

- (2) To locate the hunt spring in the specified position, shift the brush up or down, as required, as covered in 3.004.
- (3) If, after this adjustment, it is found that the tip, ring, or sleeve spring fails to meet the limits specified, readjust the springs at fault in the following manner.
 - (4) Loosen the lower assembly screw with the 206 and 207 offset screwdrivers and raise or lower the spring at fault with the 380A or R-2830 adjuster until it is within the specified limits. Tighten both assembly screws and recheck the adjustment of the other spring in the same assembly. After making this adjustment, check to see that requirement 2.24(a) can be met at other points on the bank. If the brush fails to meet this requirement, it is probably because of a displacement of the bank terminals. In this event, refer the matter to the supervisor.

- 3.25 *Downstop Collar Location* (Reqt 2.25)
- 3.26 *Clearance Between Trip Lever and Trip Rod* (Reqt 2.26)
- 3.27 *Clearance Between Trip Finger and End of Trip Lever* (Reqt 2.27)
- 3.28 *Clearance Between Brush Frame and Trip Rod Bearings* (Reqt 2.28)

(1) Check that requirements 2.23 and 2.24 are met and that the commutator brush is properly adjusted for height with respect to the brush rod as covered in Section 026-120-701.

(2) If these requirements are not met, the downstop collar has probably shifted upward on the brush rod and the setting of the H, M, and KX commutator brush springs is low. If it is noted that there is very little clearance between the trip levers of all brushes on the rod and the associated trip rods or, in the case of brush rods located adjacent to a trip rod bearing, that all the brushes on the rod just clear the adjacent trip rod bearings, proceed as follows.

(3) Loosen the downstop collar clamping screw with the KS-2630 wrench. Then raise the brush rod approximately 1/8 inch and, with the downstop collar resting on the top clutch locating plate, tighten the clamping screw just sufficiently to support the weight of the brush rod. Grasp the brush rod just below the commutator brush frame and tap the stop collar up by carefully raising and lowering the brush rod until the top edges of the H and M commutator springs and the bottom edge of the KX commutator spring are within the limits specified in Section 026-120-701, when the brush rod is resting on the downstop collar. With the downstop collar in this position, securely tighten the clamping screw.

(4) Slight adjustments of the H and M commutator brush springs may be made by adjusting them in accordance with Section 026-120-701. Do not, however, adjust the KX spring by adjusting the contact lip, since it has been previously adjusted to meet the requirement for position with respect to the X segment as specified in that section.

(5) If a brush does not reset properly, check requirement 2.22.

(6) If the brush reset lever is sluggish or fails to restore fully to its normal position, the trouble may be caused by friction between the rollers and the connecting plate on the trip lever assembly. To correct this condition, lubricate the surface of the rollers which come in contact with the connecting plate with KS-8496 lubricating compound 3. To do this, raise the brush rod and trip the brush. Apply the lubricant with the KS-14164 brush as shown in Fig. 39. After the lubricant has been applied, restore and trip the brush a few times manually to insure that the lubricant will reach the entire surfaces of the rollers where they come in contact with the connecting plate.

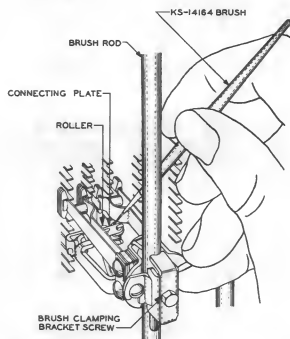


Fig. 39 — Method of Lubricating the Connecting Plate and Rollers of the Trip Lever Assembly

(7) If, after setting the downstop collar as covered previously, it is found that any or all of requirements 2.25 through 2.28 cannot be met, raise or lower the brush frame on the rod as required and shift the springs in the assemblies as covered in 3.23 and 3.24 to compensate for the shifting of the brush frame so that requirements 2.23 and 2.24 are met.

3.29 Clearance Between Upstop Collar and Bottom of Bearing Plate (Req't 2.29)

(1) To readjust the upstop collar for position, shift it on the rod as required, using the 555A wrench or the KS-2631 screwdriver to loosen and tighten the stop collar clamping screw. In tightening the clamping screw, see that the square nut, where provided, is not tilted so that the corner of the nut projects above the collar and contacts the bottom of the bearing plate instead of the upstop collar.

(2) Also check to see that, when the brush rod is raised so that the upstop collar makes contact with the bottom of the bearing plate, the brushes do not run off the topmost terminals. If this should occur, the brush will be damaged when the down drive is applied because it will not be guided back to the terminals but will snag on the topmost terminals. Remedy this by raising the stop collar nearer its minimum limit.

3.30 Clearance Between Trip Lever and Sides of Slots in Trip Finger (Req't 2.30)

(1) To readjust for this clearance on all the trip fingers on a trip rod, move the trip rod bearing adjacent to the rotating lever and shift the rod to the right or left as required, as covered in 3.14 and 3.15, taking care that requirements 2.14 and 2.15 are also met.

(2) When only one or two of the brush trip levers do not clear the sides of the slots of the associated trip fingers, adjust these trip levers to meet the requirement with a pair of KS-6015 duckbill pliers as shown in Fig. 40.

(3) Recheck requirements 2.19 and 2.22 after adjusting the trip lever.

3.31 Clearance Between Trip Lever and Trip Finger (Req't 2.31)

(1) To meet this requirement on an individual trip finger, adjust the trip finger backstop slightly with a 330B adjuster applied to the portion of the backstop nearest the trip rod. Hold the trip rod by means of the 382A trip rod holder as shown in Fig. 41. Although this figure shows the holder over the mounting screw, the holder may be used where there is no mounting screw. Before using the 382A holder make sure that the trip

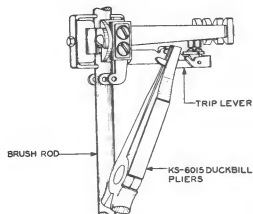


Fig. 40 – Method of Adjusting Trip Lever

finger mounting screws are tight. Check requirement 2.33 after adjusting the backstop.

(2) To change this clearance on all trip fingers on a trip rod, adjust the trip armature extension as covered in 3.12 and 3.13 or reset the rotating lever by loosening the rotating lever screw or screws with the 3-inch C screwdriver and moving the trip rod to the desired position. To obtain the maximum possible movement of a trip rod, adjust the trip armature extension so that it will engage the rotating lever as close to the fulcrum as possible, still allowing a reliable clearance between the angle portion of the trip armature extension and the rotating lever when the trip rod is held in the operated position.

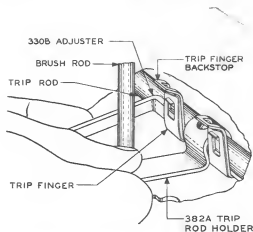


Fig. 41 – Method of Adjusting Trip Finger Backstop for Clearance Between Trip Lever and Trip Finger

3.32 Location of Trip Finger Backstop With Respect to Trip Lever (Req't 2.32)

- (1) If this requirement is not met, adjust the bent portion of the trip finger backstop with one 330B adjuster while holding the vertical portion of the backstop with a second 330B adjuster as shown in Fig. 42.

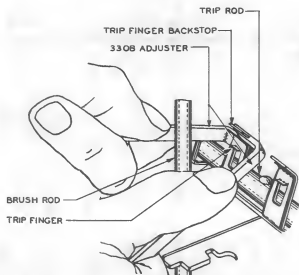


Fig. 42 - Method of Locating Trip Finger Backstop With Respect to Trip Lever

3.33 Pressure of Trip Fingers Against Their Backstops (Req't 2.33)

- (1) If this requirement is not met, adjust the trip finger close to the base with a 330B adjuster, holding the trip rod with a 382A trip rod holder as shown in Fig. 43. Before using the holder make sure that the trip rod mounting screws are tight. As mentioned in 3.31, it is not necessary to apply the holder over the head of a mounting screw.

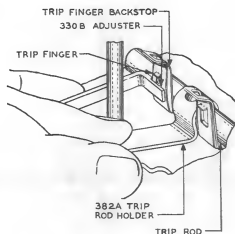


Fig. 43 - Method of Adjusting for Pressure of Fingers Against Their Backstops

3.34 Retractable Spring Tension (Req't 2.34)

- (1) To increase the tension of the rotating lever retractile spring, adjust the lug by means of which the spring is attached to the plate with the 325B adjuster as shown in Fig. 44. Exercise care in increasing the tension of this spring not to prevent the trip magnet from meeting requirement 2.35.
- (2) See that the rotating lever retractile spring is attached to the retractile spring lug, so that the end of the loop of the spring

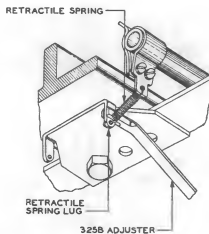


Fig. 44 - Method of Adjusting Retractable Spring Tension

passes through the hole in the lug from the front and hooks over the side edge of the lug at either side but not at the bottom.

3.35 Trip Magnet Operate and Release (Req't 2.35)

- (1) If the trip magnet does not operate and release as specified, increase or decrease the tension of the rotating lever retractile spring as required, as covered in 3.34. In ad-

justing this lug to increase the tension, do not bend it back more than approximately 45 degrees. Recheck requirement 2.34.

(2) If difficulty is experienced in meeting the requirement, make sure requirement 2.15 is met and then if necessary increase or decrease the gap between the nonfreezing disc on the armature and the pole piece nearer the fulcrum toward the minimum specified in requirement 2.11.

(3) Exercise care in attaching and removing the test clips when making this test and when obtaining battery from the trip magnet terminals for other tests on the frame to avoid loosening the trip magnet terminals.

3.36 *Brush Tripping Test* (Req't 2.36)

(1) This is a final check of other adjustments.

If the brush fails to meet this requirement, it will be necessary to refine the foregoing adjustments to produce the maximum engagement of the trip finger with the trip lever of the brush. Give particular attention to requirements 2.10, 2.12, 2.26, and 2.31.

3.37 *Smooth Brush Travel* (Req't 2.37)

(1) See that the brushes are centered so that they reliably clear all the terminals of the banks when in a reset condition as the selector travels up and down.

(2) Correct chattering or snagging by adjusting the springs causing the trouble so that their contact surfaces are within the parallelism requirement. Use the 380A or R-2830 spring adjuster for this purpose. At this time, check the location of the multiple bank terminals in accordance with Section 026-110-701.

(3) If the brush still chatters or snags, replace it with a new one as covered in Section 026-125-803.

REASONS FOR REISSUE

1. To revise the requirement covering lubrication of the trip rod bearings to replace the KS-2245 oil with KS-16326 oil [2.01(b)].
2. To revise the requirement covering compensator tape protection to replace Veedol medium cup grease with Veedol All Purpose grease (2.02).
3. To revise the List of Tools and Materials (3.001).
4. To revise the procedure covering lubrication of trip rod bearings to replace the KS-2245 oil with KS-16326 oil [3.01(1)].
5. To revise the procedure covering compensator tape protection to replace the Veedol medium cup grease with Veedol All Purpose grease (3.02).

